

USAWC STRATEGY RESEARCH PROJECT

CAN THE U.S. DO MORE TO HELP AVERT A WORLD WATER SHORTAGE?

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## ABSTRACT

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The world's fresh water supply is demonstrating signs of strain. Population increases and the resulting agricultural irrigation demands are consuming more water resources than many regions already possess and those already stressed regions are the ones projected to have some of the largest population growth in the years ahead. The transboundary nature of many rivers, the major water supplier for many regions, provides the catalyst for conflict, thus posing a direct threat to U.S. security in addition to causing great human suffering. There is much criticism that the U.S. has not taken a world leadership role in regards to water issues. However, even within the U.S. there are serious signs of water shortage in the growing west and southwest, but the U.S. has no comprehensive water strategy or policy for addressing its own water problems. This paper will examine several courses of action regarding this potential water crisis and provide a recommendation on which course of action should be adopted.



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## **CAN THE U.S. DO MORE TO HELP AVERT A WORLD WATER SHORTAGE?**

Each day, Americans wake up, flush the toilet, brush their teeth, take a shower and make coffee before even leaving for work. Americans rarely give more than a passing thought as to where this seemingly endless supply of clean water comes from and whether or not there is a chance that it could run out? Although there is a plethora of information available to the interested reader, water issues rarely gain front-page attention or make the headlines on the evening news. Unfortunately, most Americans do not give water availability much thought nor do we think of it as an issue that could potentially impact the security of the United States. Although the United States does have significant internal water concerns, these concerns are dwarfed by some of the water challenges facing other nations. These challenges come in many forms, from actual armed conflict to the lack of safe drinking water for millions of people, and the resulting instability caused by water issues could pose a security risk for the United States.

It becomes important to ask what is the United States doing about these possible security threats? Most books and articles dealing with the subject contend that the United States is not adequately addressing this critical situation. Although a water policy is not specifically mentioned in the National Security Strategy, the government does address water concerns as they develop. Water shortage issues manifest themselves in several ways and thus threaten the United States across a vast spectrum of interests. While it would certainly be convenient if the water problem could be solved by developing a water policy that would apply across the spectrum of concerns, but this is not realistic given the complexity of water shortage issues. This paper will examine the complexity of water shortages and discuss how current policies are essentially dealing with these issues and how, with just a few modifications, the United States could improve its ability to take a leadership role in the "global war on water shortage".

### **BACKGROUND**

While certainly an oversimplification, fresh water shortages are a function of three basic causes. The first deals with geography and climate and includes amount of rainfall, temperature, and location of major water sources. The second and most complex area deals with water usage as a result of population growth. The third and final area concerns the differing attitudes toward water that can pose significant challenges to developing water policies. It is the mixture of these causes in nations, cities and localities that makes water issues so difficult to address.

## **SOURCES OF FRESH WATER**

Human beings have inhabited a planet that is mostly water. Unfortunately, 97 percent of the water on earth is salt water. Salt water cannot be used for human consumption nor irrigating crops. Of the remaining three percent, over two percent is inaccessible in the polar ice caps and in deep underground aquifers, leaving less than one percent to support the world's population with drinking water, sanitation systems and food.<sup>1</sup> Unfortunately, the one- percent is not distributed equally around the world. Rainfall and fresh water sources in many parts of the world are inadequate to support populations, agriculture and industry. The main source of fresh water is surface runoff, which is captured in rivers, lakes and reservoirs and is replenished during the course of the hydrologic cycle (rain).<sup>2</sup> The difference in rainfall amounts is very significant. Most global rainfall occurs in the equatorial zone that stretches from South and Southeast Asia across Africa into Central America and the Amazon Basin and decreases north and south of this zone.<sup>3</sup> Climate also plays an important factor and scientists have long warned of possible changes to the earth's climate which can cause changes to existing weather patterns. While this can mean more rain for some areas, in fact too much rain in some instances, it can also mean too little rain for some in the arid and marginally arid areas causing devastating droughts. The El Nino phenomenon illustrates the havoc that slight changes in weather patterns can have on the environment. A critical geographic fact is that almost half of the earth's land lies in river basins shared by at least two nations and eighty percent of the world's available fresh water flows through international river basins.<sup>4</sup> Naturally this situation has created tension between nations and has contributed to or been the reason for actual armed conflict since the beginning of recorded history.<sup>5</sup>

## **FRESHWATER USAGE**

Given that fresh water is relatively scarce and not distributed optimally to begin with, water stressed areas are further aggravated by exploding population growth. It took all of history up to 1830 to put a billion people on earth, but only one hundred years to add the second billion. The third billion arrived in 44 years and the most recent billion came in just 12 years.<sup>6</sup> Using demographic modeling and assumptions, the United Nations predicts that by year 2050 the world's population will be between 7.3 billion (low estimate) to 10.7 billion (high estimate), with 8.9 billion considered as the most likely population estimate.<sup>7</sup> The rate of growth in developed countries is well under one percent per year; in developing countries it exceeds two percent per year and in some parts of Africa, Asia, and the Middle East it exceeds three percent per year. As a result, over ninety percent of all future population increases will occur in the developing

world. This means that almost all new births will be in regions where access to clean water and sanitation services are severely lacking.<sup>8</sup> Another factor in population growth is related to the drop in mortality rates. The trend of living longer began in the 19<sup>th</sup> and early 20<sup>th</sup> century, but intensified after World War II as basic sanitation, clean drinking water and modern health care became more available in many parts of the world.<sup>9</sup> It is supporting this growing population with food and basic water service that puts the greatest strain on our current water resources.

Irrigation of agriculture accounts for approximately two-thirds of global water use. As the world's population has grown, irrigation has become the foundation for feeding the world's population. During the first half of this century, the amount of irrigated land has doubled to 94 million hectares and as of 1993 there were 223 million hectares in irrigation.<sup>10</sup> Most of the expansion in irrigation has been concentrated in Asia, China, India, Indonesia and Pakistan.<sup>11</sup> However, growth in irrigated land has not kept pace with population growth.<sup>12</sup> Huge dams have been built to provide water for crop irrigation, but often with devastating effects. In many nations, large dams and reservoirs were originally considered vital for national security, economic prosperity and agricultural survival. Until the late 1970s and early 1980s, few people took into account the environmental consequences of those massive projects. Dams have destroyed the ecosystems in and around countless rivers, lakes and streams.<sup>13</sup> The Aral Sea in central Asia has all but disappeared because water from the Amu Darya and Syr Darya rivers that once sustained it have been diverted to irrigate cotton.<sup>14</sup> In addition to the ecological challenges posed by large dams, most of the economically feasible locations for big dams have now been developed.<sup>15</sup>

Another method for providing water for crop irrigation is utilizing water from underground aquifers. In some parts of the United States, groundwater is being used and is not being replaced. The vast Ogallala aquifer, which underlies much of the Midwest, is being depleted by irrigation. For instance, under the Texas panhandle, the aquifer is sinking rather dramatically. Texas farmers and ranchers have depleted the aquifer so thoroughly that the springs feeding the San Pedro River have dried up.<sup>16</sup> Another factor that impacts irrigation water use is the type of crops that are cultivated. Cotton, for instance, uses over three acre-feet of water per acre of cotton plants grown. Compare that to corn, which requires two acre-feet of water per acre of corn.<sup>17</sup> In the more industrialized countries, people eat great quantities of meat. It can take more than ten times the amount of water to produce a pound of beef than to grow an acre of grain.<sup>18</sup>

While agriculture uses 73 percent of the available fresh water, industry uses 21 percent of available water and thus is the second greatest user of fresh water.<sup>19</sup> Industry cannot be

developed nor can it survive without access to substantial quantities of fresh water. Water is an essential element in some critical industries to include the energy industry (refineries and nuclear power plants), food processing, chemical processing, pulp and paper production, and metal production.<sup>20</sup> Some industries (microelectronics and pharmaceuticals) require water that is purer than required for human consumption and when discharged into receiving waters may actually improve the water quality of that system.<sup>21</sup>

Water quality also adds to the complex puzzle of water shortage. Travelers to many parts of the world are often warned to avoid drinking the water, even in large luxury hotels. Seeing people bathe, wash their clothes, and drink from the same obviously polluted body of water is a common sight in much of the world. At least 1.5 billion people, maybe more, do not have access to a minimally adequate supply of safe water, and approximately 3 billion lack sanitation facilities, a problem that is tied to water quality.<sup>22</sup> There are several types of diseases that ravage the world due to unsafe water. Water-related diarrheal diseases are some of the worse, killing approximately 4 million people per year, 3.2 million of these people being children. Schistosomiasis, a disease carried by a water snail found in standing water, where people work, play, and use it for toilet purposes, kills 200,000 a year and debilitates another 200 million. Millions have been afflicted by "river blindness" and guinea worm disease, less life threatening, but still very debilitating. Malaria, a water-related disease, kills over one million people each year.<sup>23</sup>

Industrial and agricultural pollution impact on water supplies of both industrialized and less-developed countries. In industrialized countries industrial waste and agricultural chemicals have contaminated surface waters. Ground water resources have also become widely polluted with chemicals, many of which are known or suspected carcinogens. While grappling with the most basic water quality issues, less developed countries have to face the water quality problems posed by industrialization and chemically reliant agriculture.<sup>24</sup> For developing nations, the problem is a double-edged sword; industrialization is essential for economic growth and prosperity, but industrialization stresses already strained water resources and causes pollution. Many developing nations in their quest to industrialize, often compromise on pollution controls since it can increase production costs. Developing nation governments are often caught between the pressing need to industrialize, which produces jobs and economic growth, and the somewhat intrinsic concept of water quality.<sup>25</sup>

Another factor that contributes to water shortage is the inefficient use of water for both irrigation and city use. In many countries, 30 percent or more of the domestic water supply never reaches its intended destinations, disappearing from leaky pipes, faulty equipment or

poorly maintained distribution systems. Mexico City loses enough water in its distribution system to supply a city the size of Rome.<sup>26</sup> In regards to irrigation, many times only a small portion of the water irrigated actually touches the crops. Presently, most farmers irrigate their crops by flooding their fields or channeling the water down parallel furrows, relying on gravity to move the water across the land. During this process the plants absorb only a small fraction of the water, the rest drains into rivers or aquifers, or evaporates.<sup>27</sup> Poor water management can also have the unintended consequence of ruining the very land it is irrigating. Even the best sources of irrigation water add some level of salt to the soil. Without adequate flushing the salt can build up over a couple of decades leaving the land essentially useless. Over the past decade there has been significant loss of global agricultural land (160,000-1.5 million hectares) due to poor irrigation practices.<sup>28</sup> Poor water management can also damage plant root systems. Over watering and lack of drainage can cause the groundwater table to rise causing the root zone to become waterlogged, thus starving plants of oxygen, stunting their growth and eventually killing them.<sup>29</sup>

### **ATTITUDES CONCERNING FRESH WATER**

Attitudes are also a vital piece of the water controversy. Unlike most other natural resources, water is viewed as a free commodity and many organizations and citizens groups around the world have declared that free access to clean water is a basic human right.<sup>30</sup> Others feel there is wisdom to pricing water because it is a well-known humans do not contemplate conservation when the product is free, and conservation is one of the best tools for combating the worldwide water shortage.<sup>31</sup> A good example of a pro conservation attitude is New York City. In the early 1990s, New York City faced an imminent water shortage. The city needed an extra 90 million gallons of water a day (seven percent of the city's total daily water use). Instead of spending one billion dollars for a new pumping station, the city decided to try an alternative, reduce demand. The city did this by offering free toilets that only use 1.6 gallons of water per flush compared to five to thirty gallons per flush with regular toilets. The program was successful and the city saved 90 million gallons of water a day.<sup>32</sup> Of all personal water uses, conventional toilets are some of the greatest users of water with an average of 30 gallons per flush. Next is bathing with 20 gallons per use and then laundry with 15 gallons per use.<sup>33</sup>

Another attitude that affects fresh water usage has to do with the recycling of urban wastewater for irrigation use. The wastewater is treated and then used to irrigate various kinds of crops. While using treated wastewater to irrigate landscaping and cotton crops is a somewhat accepted practice, using wastewater for food crops is just recently becoming more

accepted.<sup>34</sup> California, for instance, has just undergone a project to irrigate 12,000 acres of strawberries using treated wastewater from the Salinas area. Wastewater technology has become so advanced that recycled water is actually safer than regular drinking water.<sup>35</sup> While very controversial, there are places in the world where untreated wastewater is used to irrigate certain kinds of crops. Many communities cannot afford to treat the large amounts of sewage produced by growing populations, but are in desperate need of water to irrigate crops. In the Mezquital Valley, Mexico, wastewater is used to irrigate over 200,000 acres of crops and China has 3.2 million acres irrigated using this method. This kind of irrigation is normally never used to grow fruits and vegetables due to the health risks.<sup>36</sup>

Attitudes on controversial issues such as population control significantly contribute to the water shortage controversy. As stated above, population growth and the challenges associated with feeding and caring for that population are some of the greatest strains on the water supply. Additionally, many areas of greatest population growth are geographically some of the driest areas on earth as well as some of the poorest. Thus, It is only logical that the concept of population control is or should be added to the list of possible water shortage coping strategies. However, many cultures and religions are extremely sensitive to any discussion or policy that has either a direct or indirect impact on reproduction practices. An example of the complex attitude toward population control is illustrated in the Millennium Development Goals. The Millennium Development Goals, agreed upon by global leaders and international agencies, are specific targets to reduce poverty by 2015. One of the initial goals was universal access to reproductive health services. This goal was eliminated from the Millennium Development Goals as a concession to a few opponents who found the concepts of reproductive health to be offensive.<sup>37</sup>

Another example of the sensitive nature of population control is the United Nations Population Fund which is the world's largest international source of funding for population and reproductive health programs. Organized in 1969, the fund works with governments, at their request, to support programs that help families and avoid unwanted pregnancies, in addition to working on preventing sexually transmitted diseases including HIV/AIDS and combating violence against women.<sup>38</sup> Studies show that fertility rates drop most rapidly where there are improved child survival rates, higher education levels (particularly for women and girls), and workable, voluntary family planning policies. Girls who learn to read and write tend to live longer and have healthier children, and are also more likely to postpone parenthood and have fewer children, thereby helping to break the cycle of poverty.<sup>39</sup> However, there is a huge amount of criticism as to what the United Nations is doing especially regarding family planning. The

internet is abundant in anti-population control rhetoric with several sites specifically criticizing the United Nations' efforts.<sup>40</sup> Unfortunately, as long as population control issues are at the root of so many cultural, emotional and religious beliefs, it will always make addressing this crucial component of water shortage exceptionally sensitive and politically unpopular.

Attitudes toward the role of private business in the water industry also play a crucial role in the water shortage problem. Because there is no overarching policy, corporations have the freedom to delve into this market and they do. We see the obvious signs of this every day in terms of the bottled water industry, but the more important battle is raging behind the scenes as business attempts to take over the water purification and delivery function of many localities in both the United States and foreign countries. This business approach to water is considered by some as the answer to many problems, but considered by others to be a disaster. Water is considered to be the petroleum of the 21st century. The water business has gone from being seen as a low-return utility, to a source of "blue gold".<sup>41</sup> Many cities and localities around the globe are facing problems of decaying water pipes and growing populations and cannot meet the demands being placed upon municipal water systems. Private business has stepped in to take over what has traditionally been a government function of supplying household water. While the companies claim they can deliver water more efficiently, that is often not the case and the cost of privately supported water is the loss of public control. There have been cases where service and access has improved under private management, but around the world, privatizations have also led to rising costs, cutoffs for poor people and companies pulling out of contracts when they can't make enough profit. Atlanta, Georgia privatized their water supply system, but because the service was so poor, they cancelled the contract. For example, three foreign owned companies now provide "for profit" water in 56 countries.<sup>42</sup> As business takes over more and more of the water supplying function, the debate over the human right to free water is intensifying. One can only predict that as shortages become more prevalent, the cost of water will increase (the demand will exceed the supply) and that the poor could be left behind in this kind of free market scenario. Actually, a version of this scenario has played itself out in South Africa, although examples from numerous other places could also be used to illustrate this problem. South Africa privatized the water delivery system and the poor could not afford to pay for the water so they were cut off from the system.<sup>43</sup> Water scarcity was not even the issue in this case, just the recovery of the cost of making water available.

## **FRESH WATER STRESS POINTS AROUND THE WORLD**

As the causes for water shortages combine, they create “symptoms” which result in a very broad spectrum of threats to the United States. While these “symptoms” occur all around the world in varying degrees, the greatest threat is one of possible armed conflict in a region vital to our national interests. The Middle East is such an area, with five percent of the world’s population and less than one percent of its renewable water resources.<sup>44</sup> Because of geography and political boundaries, the Middle East has had a long history of conflict. The Middle East has a complex system of artificial political borders and thus the various ethnic and religious groups are split amongst several countries. Water sources in the Middle East are shared by several states and the shortage of water has already impacted on industry and agriculture. Constant tension, war, large areas of unusable land (desert), a harsh and hostile climate, and ongoing political instability complicate water issues in the region.<sup>45</sup>

The Middle East experiences a very high population growth rate and has a current population of almost 300 million.<sup>46</sup> The Middle East gets its water from four main sources. These water sources include the Tigris-Euphrates River basin, the Jordan River basin, the West Bank ground water aquifer and the Nile River.<sup>47</sup> Water was considered one of the key factors that contributed to the Six-Day War and remains a crucial issue today between Palestine and Israel, especially with regard to the West Bank. Israeli forces conquered parts of Egypt, Syria and Jordan during the Six-Day War and gained control of Syria’s Golan Heights, the West Bank of the Jordan River, the Gaza Strip and the Yarkon-Taninim Aquifer. Due to these territorial gains, the Israelis now regulate the water flow from two of the three headwaters of the Jordan River. As a result of acquiring these areas, Israel now has eight times as much water as the other nations in the area. If Israel lost control of the West Bank, they would also lose control of the amount of water pumped from this very important aquifer. The dependence of Israel on this aquifer is an important dimension of ongoing peace negotiations in the Middle East.<sup>48</sup>

Turkey, Syria and Iraq are currently at odds over the Great Anatolia Project, a series of dams designed to meet Turkey’s growing water demands. Turkey is utilizing its geographic position as the upstream riparian with control of the headwaters of both the Tigris and Euphrates Rivers, and driven by the need for expanded hydroelectric production and crop irrigation to build a series of twenty-two dams and twenty-five irrigation systems. The project, scheduled for completion by 2005, is beneficial for Turkey but will deprive Syria and Iraq of badly needed water. Syria contends that Turkey’s Great Anatolia Project will reduce the flow of water from the Euphrates by forty percent. Iraq contends that this project will reduce water flow to Iraq by ninety percent<sup>49</sup> With Turkey’s control of water at the heart of the problem, the Great

Anatolia Project has become a potential terrorist target that must be heavily guarded. Syria is supplying both arms and operational land bases to Turkey's Kurdish separatists. In addition, Syria has sided with Iraq to condemn and undermine Turkish dominance of the water situation.<sup>50</sup> The U.S. has labored for years to mitigate conflict in the Middle East as it considers stability in this area vital to United States national interests. As the population continues to grow in this region of scarce water resources, additional disputes are certainly inevitable.

Another water-challenged country of great interest to the United States is China. With twenty-one percent of the world's population, it has only eight percent of the earth's renewable fresh water. Like many other countries, the water shortage impacts one part of the country more than others and in China it is the northern part of the country that is dealing with the greatest water shortages.<sup>51</sup> The North China Plain is the country's agricultural heartland and produces over half of China's wheat and over a third of its corn. The water table under this plain is falling much faster than originally predicted. Continued water shortages could cause grain harvests to decline and the country may have to resort to importing food to feed the population. This kind of increased food demand could have a devastating impact on world food markets, driving up food prices.<sup>52</sup> Of 688 major Chinese cities some 400 are facing water shortages with over 300 experiencing groundwater shortages. In addition, at a time when use already exceeds the replenishment rate, the problem is being exacerbated by a rising standard of living. As China strives to raise the standard of living for its people, the people are using more and more water per person.<sup>53</sup> Because China is such a large country, the disagreements about water are mostly internal. But lack of water is having another consequence, which is illegal migration into Russia's Far East. The lack of water in northern China has created 100 million economic and ecological refugees who have no place to go in their own country, thus they are illegally migrating into land that previously belonged to China 140 years ago but now belongs to Russia.<sup>54</sup> Although Russia appears tolerant of this situation for now, given time and additional migration, this situation could certainly manifest into a future conflict.

These same kinds of issues also have a large impact on Asia and Africa. The Indus River basin, which begins in Tibet but supplies India and Pakistan, has long been a source of conflict between those two states. Tensions persisted from 1947 until 1960 when the World Bank helped negotiate a treaty apportioning the Indus water resources.<sup>55</sup> Conflict also exists between India and Bangladesh concerning the Ganges River, which flows from the Himalayas through India and Bangladesh, where it joins the Brahmaputra River and finally empties into the Bay of Bengal.<sup>56</sup> In 1975, India began diverting water from the Ganges, upstream from Bangladesh. Bangladesh took this issue to the United Nations and in 1977, the United Nations worked out a

settlement to share the water, and though it was only designed to last five years, it is still in effect today.<sup>57</sup>

In Africa, the Okavango River is a critical water resource supplying southern Africa. It supplies, Angola, Namibia and Botswana and large stretches of the Kalahari Desert. In 1996 Namibia put forth a proposal for construction of a water pipeline which would pump up to 26 million cubic yards of water annually from the Okavango River to supply Namibia's growing central area to include the capital city of Windhoek.<sup>58</sup> Botswana is legitimately concerned that diverting this much water will deprive the Okavango Delta of water where over a hundred thousand people reside. A joint water management commission has been established in an attempt to peacefully resolve the conflict. The commission will evaluate the effects of the Namibian water pipeline on the downstream flow of the Okavango River and attempt to negotiate a solution.<sup>59</sup> Even though these particular water disputes, to date, have had success through negotiation and compromise, these areas still represent water stress points that as conditions change (additional population or prolonged drought) could spur additional controversy and possible armed conflict.

Water shortages produce great humanitarian consequences that can also threaten the interests of the United States. Access to basic water services is one of the most fundamental conditions of human development and without it local populations are generally condemned to generations of poverty and disease. Yet as we enter the twenty-first century, billions of people lack such access. More than 1 billion people in the developing world do not have safe drinking water and nearly 3 billion live without access to adequate sanitation systems necessary for reducing exposure to water related diseases. In developing nations, the shortage of water and archaic or nonexistent distribution systems are particularly difficult on women and children. Children are prevented from attending school and women are virtually enslaved to their water carrying responsibilities.<sup>60</sup> While poverty, disease, hunger and lack of education can directly provide the catalyst for regional instability and conflicts, they also provide the conditions that terrorists seek to exploit, and they can also inhibit the spread of democracy, in contradiction to United States national interests.<sup>61</sup>

#### **FRESH WATER CONCERNS WITHIN THE UNITED STATES**

The United States is not without its own international border disputes concerning fresh water. The United States shares several lakes and rivers with its neighbors to the North and South and over the years has had numerous disputes with both Canada and Mexico.<sup>62</sup> After a period of tension with Mexico, a treaty was negotiated in 1944 that regulated the allocation of

water from the Colorado River for both the United States and Mexico. The treaty stipulated that Mexico would receive a minimum of 1.5 million acre-feet of water per year, and if a surplus existed during a particular year, it could receive up to 1.7 million-acre feet of water per year.<sup>63</sup> In the 1960s, conflict surfaced again with Mexico, but this time it concerned water quality, not quantity. Arizona was dumping its agricultural wastewater into the Colorado River causing the water to be very salty, subsequently ruining agricultural land in Mexico.<sup>64</sup> Conflict over this issue raged for over a decade until 1973 when the United States agreed to fund and build a desalinization plant that would treat water coming from Arizona. This agreement stipulated a water quality standard for water that Mexico would receive from the United States.<sup>65</sup>

The United States has also had a number of disputes with its' northern neighbor, Canada. One of the longest began in 1951 over the building of the Libby Dam on the Kootenay River in Montana. The dam would have created a reservoir that would have flooded 68 km of Canadian territory. Although the United States offered to compensate Canada for the lost land and necessary relocations, it would not provide Canada any benefits for the resulting power generated. Canada threatened to divert water from the Kootenay River in an effort to deny water to the dam site. Eventually the dispute was settled with the 1961 Columbia River Basin Treaty.<sup>66</sup>

Some of the most contentious water debates for the United States are internal and come from trying to sustain a viable water base for the American West and Southwest. The climate in these areas is mild with little rain, but they have attracted a large and growing population who are impervious to the fact that they are living in an area of limited water.<sup>67</sup> Take for instance Phoenix, Arizona, which only gets seven inches of rain per year, yet the average family uses 780 gallons of water per day. This water usage rate is accomplished through a technological marvel called the Central Arizona Project that transports water from the Colorado River.<sup>68</sup> Compare this to Namibia, the driest country south of the Sahara. It receives ten inches of rain per year, three more inches than Arizona, but the average family uses one-gallon of water per day.<sup>69</sup> The Southwestern states are heavily dependent on the once-abundant Colorado River which is quickly being over utilized. Originating in the Wyoming Rockies, the Colorado River winds through 1700 miles of some of the driest country in the United States before crossing into Mexico and emptying into the Gulf of California. Numerous diversions, including 17 major dams, drain off the river's water for use by more than 21million residents and farmers in seven states.<sup>70</sup>

California is the poster child for water problems in the American West. California has a population of over 31 million; a population greater than Canada and 161 other nations. The

population is growing at a rate of 2.7 percent annually which means that in 30 years the population will be between 48 to 60 million.<sup>71</sup> Agriculture in California's Central Valley is almost completely irrigated and 50 percent of that irrigation water is drawn from water aquifers that are often heavily over pumped. The entire irrigation system is experiencing water quantity and quality problems and soil degradation which is the cause for decreasing crop yields.<sup>72</sup> Los Angeles realized that supplying water to the growing population would always be an expanding requirement and as a result purchased Owens Lake, the third-largest body of water in the state. Los Angeles used all of the water in the lake and it is now called "Owens Dry Lake".<sup>73</sup> Like so much of the Southwest, Southern California is dependent on the Colorado River for over half of its water. The Colorado River supplies Los Angeles, San Diego, Phoenix, and Las Vegas. So much of the Colorado River is so used on its way to the sea, that virtually no water reaches its dried-up delta at the head of the Gulf of California.<sup>74</sup> Las Vegas has a population of over two million and is growing by 1500 people a week. Nevada is the most arid of all states receiving only four inches of rain a year. Las Vegas could be the first state in the Colorado River Basin to run out of water.<sup>75</sup> After decades of controversy, seven states (Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming) signed an agreement in 1922 that, today, still governs state allocations of the Colorado River. Once approved by Congress, the Colorado River Compact became the first agreement of this type between states that was ratified by the federal government. Unfortunately, the allocations are now not sufficient to supply the areas growing population and disagreements will certainly continue to develop as the population grows.<sup>76</sup>

The United States has looked to technology to assist in addressing the water shortage problem. Two of the most promising technologies are desalinization and improved crop irrigation techniques. The Water Desalinization Research and Development Act of 1996 provided 52 million dollars to promote desalinization research and development to lower the cost of desalinization within the United States. This legislation authorized an expanded United States research and development program to produce lower-cost desalinization technologies. It authorized a basic research and development program to be conducted by the Department of the Interior and the Department of the Army and authorized the development of experimental desalinization facilities. It also required the Agency for International Development to host a conference for countries either currently using or planning to use desalinization technologies. The legislation also required the Secretary of the Interior, in consultation with the Secretary of the Army, to report yearly on the progress made in desalinization technology as a result of this legislation, as well as the agency's plans for the following year.<sup>77</sup>

The history of the Federal Government's involvement in desalinization dates back several decades . In the 1950s and 1960s, considerable effort and resources were devoted to research and development of desalinization technology, particularly during the Kennedy Administration. According to a 1988 report by the Office of Technology Assessment, U.S. industry was generally considered to be at the forefront of desalinization technology throughout the 1960s and into the 1970s. When governmental support for this technology was eliminated during the 1970s, however, Japanese and European firms, some of which were supported by their respective governments, began obtaining contracts that previously would have been awarded to American firms.<sup>78</sup>

Improvement in irrigation techniques could also provide significant water savings. Drip irrigation systems show particular potential. Drip systems allow the water to be delivered directly to the plants' roots with very little water wasted to evaporation. Drip irrigation has been shown to reduce water usage by 30 to 70 percent and increases crop yield by 20 to 90 percent compared with flooding methods.<sup>79</sup> Sprinklers can also be designed to perform almost as well as drip methods. Traditional high-pressure irrigation sprinklers spray water high into the air in order to cover as large a land area as possible. Unfortunately the longer the water spends in the air, the more it tends to evaporate before reaching the crops. Low-energy sprinklers have been designed to deliver water in small doses through nozzles positioned just above the ground. Several Texas farmers who installed these kind of sprinklers have learned that plants tend to absorb 90 to 95 percent of the water delivered in this manner. Although these results are impressive, very few farmers use these new systems.<sup>80</sup> Within the United States, there are efforts underway to implement and continue research in irrigation techniques. While just as recently as 2004, farmers and ranchers in West Texas received a portion of over four million dollars in research funding to assist in finding more efficient irrigation technologies.<sup>81</sup> Although two examples of technology funding are provided here, these represent a fraction of the huge amounts of money routinely provided through various agencies to fund research in a variety of areas.

#### **CURRENT UNITED STATES POLICY ON FRESH WATER**

It is clear that the lack of fresh water definitely poses a threat to several United States security interests. So the question remains: what should be the United States policy for dealing with this full spectrum threat? Currently there is no comprehensive policy for dealing with the "causes" of water shortage either internationally or domestically. The State Department is designated as the lead agency in this area and Mr. Aaron Salzberg, point of contact for water

resource management at the State Department, states that the United States deals with water issues on a case-by-case basis.<sup>82</sup> This essentially means that the United States deals with treating the symptoms of water shortage as opposed to addressing the causes of water shortage. While there is no mention of “water” in the current National Security Strategy (NSS), one finds multiple references to the consequences of water shortages such as terrorism, regional instability and poverty, which threaten United States interests. There are, however, several specific references to water in the *FY2004-2009 Department of State and USAID Strategic Plan*. The plan mentions the need for safe drinking water and sanitation in support of a variety of areas to include health, environment and economic prosperity and security. The plan also acknowledges the looming food shortage as a function of the shortage of fresh water.<sup>83</sup> This official document actually mentions the “shortage of fresh water” and thus represents an important nuance in the way the State Department is beginning to view water issues. Instead of just viewing water as just a matter of access, the State Department is at least starting to acknowledge that there is a fresh water shortage and that this problem has consequences. The risks associated with ignoring the causes of water shortages are great. The United Nations predicts that by 2025, humans will use more than ninety percent of the available fresh water, leaving just ten percent for all other life on earth.<sup>84</sup>

Unfortunately, the United States is also domestically struggling with water challenges and has no comprehensive plan or umbrella agency for managing and protecting our national water resources. Most water issues within the United States are handled at the state and local level. There has been some national level water legislation, but primarily in regards to water quality, such as the clean water act.

As discussed previously, water quality is one of the greatest threats to freshwater availability. While today Americans may water quality for granted, it was not all that long ago, 1972, that the Clean Water Act was passed.<sup>85</sup> Historically, American factory owners built their plants next to rivers, which provided hydropower, ease of shipping and easy waste disposal. By the 1960s, many lakes and rivers within the United States were too polluted to support fish and aquatic plants. In 1969, an especially foul debris-laden section of Cleveland’s Cuyahoga River actually caught fire, resulting in calls for government intervention to clean up the nation’s waterways.<sup>86</sup>

The result was the Clean Water Act, which required factories, utilities and sewage-treatment plants to reduce toxic-waste discharges into the waterways. Since then, water pollution from these sources has diminished and in many places fish and wildlife have returned. This legislation has had significant success in that sixty percent of the nation’s waters are now

clean enough to support fishing and swimming.<sup>87</sup> Unfortunately the other forty percent of waterways still require additional work. While easily identifiable sources of pollution have been controlled, “runoff pollution” has proven to be a tougher challenge. Runoff pollution or non-source specific pollution is difficult to identify. It originates from farms using fertilizers, to suburban lawns and city streets and storm sewers and it even originates in the air.<sup>88</sup> For instance, when power plants burn coal, they produce mercury vapors. Rain and snow return the mercury compounds to lakes and streams thereby contributing to their pollution.<sup>89</sup> Thus, we now have air quality issues impacting water quality, which is not to imply that there has not been significant legislation concerning air quality. The same National Environmental Policy Act (NEPA) which provided legislation for water quality also provided legislation for air quality and just like water, has had significant success in improving air quality throughout the United States.<sup>90</sup> What this illustrates is the complex nature of our water resources and the sensitivity of those resources to a variety of both direct and indirect threats.

While this brief history on environmental protection may tend to imply that the successes of clean air and water legislation have been easily won, that is certainly not the situation. There has been great improvement in environmental quality, but most has been achieved through significant struggle between the environmentalists and industrialists. Most of the current successes, however, have been targeted at the direct and easy to ascertain issues, such as banning the pesticide DDT, installing scrubbers on coal burning smokestacks and halting the discharge of industrial waste into the waterways.<sup>91</sup> The second generation of environmental improvements, reducing the non-source pollution will cost more and be politically harder to accomplish. Environmentalists believe President Bush has the worst record of any presidential administration in terms of protecting the environment.<sup>92</sup> Advocates of Bush's policies praise his actions contending that they allow better flexibility to enable companies to comply with regulations without putting them out of business.<sup>93</sup> What this illustrates is the complexity of protecting the American water supply, complexities which are no less significant in every other country of the world.

## **COURSES OF ACTION**

Given the grave threat that water poses to national security as well as to life on earth as we know it, it seems obvious that the United States should be actively engaged to help prevent this disaster from occurring. There are basically three options available: continue with the current policy of addressing the symptoms of water shortage, continue with the current policy

but look for more aggressive ways to treat the causes of water shortage, and finally develop a comprehensive policy to address the causes of global water shortage.

### **COURSE OF ACTION 1**

The current United States policy is to wait until a water problem manifests itself (ways) and then provides financial and diplomatic resources to solve the problem (means). An outcome of this policy is that it allows the nongovernmental environmental organizations to provide an active role in raising public awareness as well as building public consensus in such areas as pollution, water conservation, and even in conflict resolution.<sup>94</sup> These organizations also delve into the controversial area of family planning. The fact that they are non-governmental may be one of their greatest advantages in terms of being able to discuss and address family planning issues. Given the anti-American sentiment that is becoming more in vogue, these organizations have more latitude to deal with sensitive issues and not get caught in the quagmire of international politics that has a distinctly anti-American flavor. These organizations are a “means” of dealing with water issues, but because most are independently funded, the government has little control over where and how they chose to intervene.

This reactionary strategy has also allowed the United Nations to legitimately step up and take a leadership role on this very crucial issue. The United Nations declared 2003 the International Year of Water and hosted the Third World Water Forum in Kyoto Japan in March of 2003 as a follow up to the Johannesburg Earth Summit in April of 2002.<sup>95</sup> Interestingly enough, during the opening remarks at the Johannesburg Summit, one view expressed was that the western industrialized nations are consuming too many natural resources and that this is creating the environmental disaster that is threatening human life.<sup>96</sup> This illustrates the anti-American sentiment that influences much of the world when it comes to environmental issues and certainly brings into question the United States’ ability to take an overarching leadership role in regard to a sensitive environmental issue such as water. Standing back and allowing the United Nations to take a leadership role is a realistic “way” of addressing the water crisis given the world’s disillusionment, justified or not. However, just because the United States is not leading the conference, does not mean that the United States is not involved. In fact, Paula J. Dobriansky, Under Secretary of State for Global Affairs, led the United States delegation that attended both of these conferences.<sup>97</sup> However, one can assume the United States will be expected to provide significant “means”, most likely in the form of funding, to support the strategies that are developed at these summits and conferences. As courses of action go, this one is rather low-risk for the United States. Even if we do not like the strategies put forth at the

summit, we can certainly limit or restrict funding in support of that strategy or specific strategies that are not in line with our policies.

The greatest risk of the reactive strategy is the impact that business and privatization can have on this life essential resource. It could be argued that without strong leadership and intervention by the United States, business would continue to privatize water with a purely free market view. As water becomes increasingly scarce, the greater the risk that the law of supply and demand will prevail and that water will be made available to only those who can afford it.

Technology offers some of the greatest hope in the battle against water shortage and given the incredible research capability of the United States, this is most viable way of using our means to produce viable solutions to the global water shortage. While some examples of technology advancement were touched upon earlier, these represent only a fraction of the huge amounts of state and federal money that is routinely provided through various agencies to fund research in a variety of water related areas. However, perhaps this decentralized approach to research and development is not the best way to attack the water issue, and maybe a more centralized approach would be a better use of our means and return better and faster results.

The greatest advantage of our current water strategy is that it takes the “soft” approach to a very emotional and politically charged global issue. We are letting the United Nations and nongovernmental organizations take the lead in attempting to gain global consensus while we deal on a case-by-case basis with any significant threats to our interests, simultaneously pouring millions of dollars into research without much synergy of purpose. Unfortunately, private business is executing its own agenda and does not seem to be concerned that this could be leaving the poor without access to water. Perhaps it is time that the United States considers a more holistic way to approach the water problem and looks at combining resources to deal with water issues across a broader and more integrated spectrum.

## **COURSE OF ACTION 2**

A second course of action would essentially keep our reactive (soft) strategy, but create something along the lines of a national water commission that would look for ways to combine resources and approach water issues from a more holistic perspective with emphasis on battling the causes of water shortage.<sup>98</sup> While it is crucial that we still maintain a “soft” approach to water issues internationally, the commission could start by looking at the water situation within the United States. As discussed earlier, it can be said that the United States manifests most of the same symptoms and causes of water shortages prevalent in the rest of the world. There are actual water shortages in the west, over-utilized aquifers, pollution, conflicts with Mexico and

Canada over water usage, conflicts between states over water usage, inefficient and aging infrastructures, lack of conservation and failed privatization attempts. The United States' internal water policy is just as reactive and decentralized as is its external policy.

The United States has basically relied on states and localities to manage water and while this has been relatively successful over the years, the magnitude of the water problem is starting to make this course of action untenable. It is hard for the United States to become the world's water conscience when it can't even solve the problems within its own borders. A national commission on water could begin by developing internal strategies to ensure the future water supply of the United States. Once that is done, it will be much easier to export these strategies to the rest of the world.

As alluded to above, one of the first things the national water commission could do is focus the research and development efforts. The United States has some of the greatest minds and best research facilities on the planet. It must harness the ongoing efforts and bring the minds and the research together and create a synergy comparable to that of the space program. If equal effort were applied, the United States would have economically viable alternative sources of water. While additional sources of water are key, conserving the current supply is equally if not more crucial. The commission must create public awareness as well as create incentives or assess penalties for wasting water. This in turn forces the United States to come to terms with what its attitude toward water will be. Is water a basic human entitlement, or should water come with some price tag or perhaps it is a combination of both? This in turn will help the commission determine the future of water privatization within the United States and thus help formulate what the United States position will be on this issue globally.

This reactive, but focused approach to water policy has several advantages. It continues to let the less controversial agencies take the lead, for now, while the United States determines how it wants to address water issues, at the same time focusing our technological and research means for better options. As the United States faces its domestic water issues, it will be better able to frame exportable strategies that will assist the rest of the world.

### **COURSE OF ACTION 3**

There is another course of action available to the United States and that is the proactive approach. While the gravity of the world's water situation could certainly use a proactive and aggressive leader to spearhead the battle in the global water struggle, we need to ask ourselves, is the United States up to this task? Considering that the United States has not even formulated the ways to address the problem within our own borders, it is doubtful that we

possess the knowledge and experience to confront the issue on a global scale. If the United States desires to take the lead in this global struggle, then it has to formulate strategies for addressing water shortage globally. While the proactive approach is probably in the future of the United States, it is doubtful that it could assume this role now. First, the United States must establish itself as the leader in water related research and technology development. Second, it must determine if and how water is to be privatized and what the fundamental attitude toward water will be. Lastly, the United States must develop a comprehensive water policy for the homeland that will ultimately result from progress in the first two issues. The only way to lead in the global war on water shortage will be from the front.

## **RECOMMENDATION**

Over the next few years, the lack of fresh water will be the catalyst for greater tension and conflict around the world that will increasingly threaten United States interests. There is no simple solution to the water crisis, but by adopting course of action number two, the United States can start to address water issues more holistically. The formation of a national water commission can help focus research and technological efforts as well as look at ways to address the water situation within the United States, thereby forcing policymakers to come to terms with the philosophical controversies at the core of the policy debate. Once the United States formulates its policy on water, puts policies in place to address the concerns at home, focuses the research and technology effort, then it will be in a better position to assume a global leadership role in the struggle against the world's water shortage.

WORD COUNT=8744



## ENDNOTES

<sup>1</sup> Peter H. Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources* (New York: Oxford University Press, 1993), 3.

<sup>2</sup> Ibid., 15.

<sup>3</sup> Ibid., 15.

<sup>4</sup> Diane R. Ward, *Water Wars* (New York: Riverhead Books, 2002), 174.

<sup>5</sup> A list of 55 water conflicts is provided from the beginning of history to 1999 by Peter H. Gleick, *The World's Water 2000-2001* (Washington D.C.: Island Press, 2000), 184-189.

<sup>6</sup> Ward, 3.

<sup>7</sup> Richard E. Benedick, "Human Population and Environmental Stresses in the Twenty-first Century," *Environmental Change and Security Project Report* (Summer 2000); available from <<http://ecsp.si.edu/listserv>>; Internet; accessed 9 November 2004.

<sup>8</sup> Information concerning the rates of growth and new births is taken from Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 105.

<sup>9</sup> United Nations Population Fund, *"The State of World Population 1999; 6 Billion A Time for Choices,"* (United Nations Population Fund, 1999), 19.

<sup>10</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 56-57.

<sup>11</sup> Benedick.

<sup>12</sup> Benedick.

<sup>13</sup> Mary Cooper, "Water Shortages," 1 August 2003; available from <<http://library2.cqpress.com/cqresearcher/document>>; Internet; accessed 17 September 2004.

<sup>14</sup> Diane Martindale, "How We Can Do It," *Scientific American*, February 2001, 42.

<sup>15</sup> Cooper, "Water Shortages".

<sup>16</sup> Mary Cooper, "Will the Earth Run Out of Fresh Water," 15 December 1995; available from <<http://library2.cqpress.com/cqresearcher/document>>; Internet; accessed 17 September 2004.

<sup>17</sup> "Water Plan Gives Farmers Options, Promotes Conservation," U.S. Water News Online November 2004; available from <http://www.uswaternews.com/archives/arconserv/4waterplan11.htm>; Internet; accessed 30 November 2004.

<sup>18</sup> Martindale, 44.

<sup>19</sup> Kent H. Butts, "The Strategic Importance of Water," *Parameters Online* Spring 1997. (Journal on-line); available from <<http://carlisle-www.army.mil/usawc/parameters/97spring/butts.htm>>; Internet; accessed 26 August 2004.

<sup>20</sup> Ibid.

<sup>21</sup> Constance E. Hunt, *Thirsty Planet Strategies for Sustainable Water Management*. (London: Zed Books, 2004), 47.

<sup>22</sup> Dr. Paul Simon, *Tapped Out* (New York: Welcome Rain Press, 2001), 12.

<sup>23</sup> The information contained in this paragraph concerning diseases was taken from Simon, 9.

<sup>24</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 25.

<sup>25</sup> The discussion on industrialization and pollution in third world countries was taken from Butts.

<sup>26</sup> Martindale, 43.

<sup>27</sup> Sandra Postel, "Growing more Food with less Water," *Scientific American* (February 2001): 48.

<sup>28</sup> The information in this paragraph concerning salt build up on cropland is taken from Hunt, 68-69.

<sup>29</sup> Ibid., 68.

<sup>30</sup> Peter Gleick, *The World Water, 200-2001* (Washington D.C.: Island Press, 2000), 1.

<sup>31</sup> Cooper, "Will the Earth Run Out of Fresh Water".

<sup>32</sup> Martindale, 54.

<sup>33</sup> Hunt, 99.

<sup>34</sup> Lisa Lieberman, "Recycled Wastewater Used to Irrigate Crops in California," *The Vegetable Growers News* 2001; available from [http://www.vegetablegrowersnews.com/pages/2003/issue\\_03\\_05/03\\_05\\_recyled\\_water.html](http://www.vegetablegrowersnews.com/pages/2003/issue_03_05/03_05_recyled_water.html)>; Internet; accessed 2 December 2004.

<sup>35</sup> Ibid.

<sup>36</sup> Peter Swanson, *Water the Drop of Life* (Minnetonka: North Word Press, 2001), 75.

<sup>37</sup> The discussion on the Millennium Development Goals was taken from United Nations Population Fund, *State of World Population 2002: People, Poverty and Possibilities* (New York: United Nations Population Fund, 2002), 45.

<sup>38</sup> The discussion on the United Nations Population Fund was taken from the "United Nations Population Fund," available from <<http://www.unfpa.org/about/index.htm>>; Internet; accessed 31 October 2004.

<sup>39</sup> United Nations Population Fund, "*The State of World Population 1999; 6 Billion A Time for Choices*," 19-22.

<sup>40</sup> There are numerous anti-population control groups such as "Population Research Institute," available from <<http://www.pop.org/>>; Internet; accessed 18 January 2005.

<sup>41</sup> Bob Carty, "The Water Barons; A Look at the World's Top Water Companies," 3 February 2003; available from <<http://www.cbc.ca/news/features/water/business.html>>; Internet; accessed 3 October 2004.

<sup>42</sup> The information concerning water privatization was taken from Ibid.

<sup>43</sup> Bob Carty, "Whose Hand on the Tap," 3 February 2003; available from <<http://www.cbc.ca/news/features/water/business.html>>; Internet; accessed 3 October 2004.

<sup>44</sup> Peter Swanson, *Water the Drop of Life* (Minnetonka: North Word Press, 2001), 125.

<sup>45</sup> The discussion of the Middle East geography, boundaries and water resources was taken from Butts.

<sup>46</sup> United Nations Population Fund, 23.

<sup>47</sup> Butts.

<sup>48</sup> All information pertaining to the discussion of Israel and the Six Day War was taken from Swanson, 124-125.

<sup>49</sup> All information pertaining to the Great Anatolia Project was taken from Ibid, 120-121.

<sup>50</sup> Ibid, 121.

<sup>51</sup> All information pertaining to water and China was taken from Simon, 65.

<sup>52</sup> All information pertaining to water and China was taken from Antoaneta Bezlova, "Development-China: Water Woes Threaten to Dry out North." *Global Information Network*, 10 June 2004 (database on-line); available from ProQuest; accessed 27 August 2004.

<sup>53</sup> "China's Underground Water Supply Dwindling," *The Australian*, 4 November 2003; available from <http://www.theaustralian.news.com.au/printpage/0,5942,7764531,00.html>; Internet; accessed 20 November 2003.

<sup>54</sup> Benjamin Fulford, "The Dragon The Bear," *Forbes*, 17 March 2003; (database on-line); available from ProQuest; accessed 27 August 2004.

<sup>55</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 94.

<sup>56</sup> Ibid., 95.

- <sup>57</sup> Ibid., 95.
- <sup>58</sup> The information concerning the Okavango River was taken from Swanson, 122.
- <sup>59</sup> Ibid., 122.
- <sup>60</sup> The information concerning access to fresh water was taken from Simon, 60-61.
- <sup>61</sup> George W. Bush, *The National Security Strategy of the United States of America* (Washington D.C.: The White House, October 1998), page 2 of introduction.
- <sup>62</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 96.
- <sup>63</sup> Joachim Blatter and Helene Ingram, eds., *Reflections on Water: New Approaches to Transboundary Conflicts and Cooperation* (Cambridge, MA: The MIT Press, 2001), 68.
- <sup>64</sup> Ibid, 70-71.
- <sup>65</sup> Ibid, 72.
- <sup>66</sup> The information concerning the water dispute between the United States and Canada was taken from Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 96.
- <sup>67</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 87.
- <sup>68</sup> The information concerning Phoenix Arizona and the water supply was taken from Swanson, 53.
- <sup>69</sup> Swanson, 50.
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- <sup>71</sup> The information concerning California was taken from Simon, 17.
- <sup>72</sup> Gleick, *Water in Crisis: A Guide to the World's Fresh Water Resources*, 87.
- <sup>73</sup> Simon, 21.
- <sup>74</sup> Ibid, 22.
- <sup>75</sup> Simon, 23-24.
- <sup>76</sup> The information concerning the Colorado River was taken from Simon, 26-27.
- <sup>77</sup> All of the information concerning legislation and desalinization was taken from *Water Desalinization Research and Development Act of 1996, United States Code Congressional and Administrative News*, 104<sup>th</sup> Cong., 2<sup>nd</sup> sess., 1996. Available from <[http://thomas.loc.gov/cgi-bin/cpquery/?&db\\_id=cp104&r\\_n=sr254.104&sel=TOC\\_13746&](http://thomas.loc.gov/cgi-bin/cpquery/?&db_id=cp104&r_n=sr254.104&sel=TOC_13746&)>; Internet; accessed 3 October 2004.

<sup>78</sup> The information concerning the history of desalinization was taken from Ibid.

<sup>79</sup> Postel, 50.

<sup>80</sup> The information concerning irrigation was taken from Postel, 50.

<sup>81</sup> “*President Approves More than \$127 Million in Funding for 23<sup>rd</sup> District*,” 5 February 2004, available from <<http://www.house.gov/bonilla/23rd.html>>; Internet; accessed 3 October 2004.

<sup>82</sup> Roy C. Bierwirth, *U.S. International Fresh Water Policy-Need, Analysis, and Recommendation*, Strategy Research Project (Carlisle Barracks: U.S. Army War College, 22 February 2002), 10.

<sup>83</sup> Colin Powell and Andrew S. Natsios, *FY 2004-2009 Department of State and USAID Strategic Plan* (Washington D.C.: The Department of State and USAID, August 2003), 24.

<sup>84</sup> Cooper, “Water Shortages”.

<sup>85</sup> Mary Cooper, “Bush and the Environment,” 25 October 2002; available from <<http://library2cqpress.com/cqreacher/document>>; Internet; accessed 21 October 2004.

<sup>86</sup> Ibid.

<sup>87</sup> Ibid.

<sup>88</sup> Ibid.

<sup>89</sup> Ibid.

<sup>90</sup> Ibid.

<sup>91</sup> Ibid.

<sup>92</sup> Ibid.

<sup>93</sup> Ibid.

<sup>94</sup> Organizations such as the Pacific Institute are dedicated to protecting our natural world, encouraging sustainable development, and improving global security. The aim is to find real-world solutions to problems like water shortages, habitat destruction, global warming, and environmental terrorism. They conduct research, publish reports, recommend solutions, and work with decision-makers, advocacy groups, and the public. The interdisciplinary approach enables the Pacific Institute to bring opposing groups together to forge effective real-world solutions. In recent years, the Institute has brought together conflicting parties in Georgia, Armenia, and Azerbaijan, Central America, and the Middle East to explore ways of moving toward cooperation over water. This information is taken from the Pacific Institute Website ; available from <[http://www.pacinst.org/topics/water\\_and\\_sustainability/water\\_and\\_conflict/](http://www.pacinst.org/topics/water_and_sustainability/water_and_conflict/)>; Internet; accessed 3 October 2004.

<sup>95</sup> Cooper, “Water Shortages”.

<sup>96</sup> Jerry Taylor, "Unsustainable. It's the third world, not the West," 28 August 2002; available from <<http://www.nationalreview.com/comment/comment-taylor082802.asp>>; Internet; accessed 3 October 2004.

<sup>97</sup> Paula J. Dobriansky, "Open Letter to the Third World Water Forum," 14 March 2003; available from <<http://www.state.gov/g/rls/rm/2003/19001.htm>>; Internet; accessed 3 October 2004.

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